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ABSTRACT

This curriculum unit deals with the establishment and maintenance of a saltwater aquarium in the classroom. The unit seeks to arouse the student's curiosity and interest in the aquatic environment by involvement in the sequence of activities relating to the marine aquarium. Detailed instructions are provided in preparing and stocking the aquarium. Teaching suggestions are included along with technical instructions. Appendices include: (1) a list of aquarium supplies; (2) marine life suppliers; (3) book publishers; and (4) a story relating concepts of the marine environment. (RE)

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SENSING THE SEA

kindergarten–
grade one

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SENSING THE SEA

A Curriculum Guide in Marine Education

for

grades kindergarten and first

Educational Series Number 23
Virginia Institute of Marine Science

Ellen Odell-Fisher
School of Marine Science

Ronald N. Giese
School of Education

of

The College of William and Mary

and
contributing editor to the
"Helpful Hints"

Mary E. Sparrow
Virginia Institute of Marine Science

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School of Marine Science

and

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College of William and Mary in Virginia

1978

PREFACE

Most education is very land-oriented. Children learn shapes, colors, sizes, and textures from materials, plants, and animals found on land. There is another seventy percent of the earth that most people tend to ignore, the sea. If young children are to develop responsible attitudes through a total understanding of the earth they must be exposed to all of its environments.

The overall purpose of this unit is to arouse curiosity and interest in the aquatic environment through involvement. The teacher's role is one of asking divergent questions for which the student proposes possible solutions rather than deciding specific "correct answers". Throughout these lessons the process skills of investigation are most important. Facts are vehicles for developing interest in the marine environment and for teaching inquiry skills, particularly the skill of questioning.

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INTRODUCTION

In this unit, both you and your students will be working together to establish a saltwater aquarium in your classroom. Setting up and maintaining the aquarium should be carried out with and by your students. The function of the following "Helpful Hints" material is to provide background information for you. It should not be presented to your class per se; it should be used by you to help focus your students' questioning. Don't shelter your students from the frustration of learning by trial and error or from the joy of successfully mastering real problems. When difficulties arise, elicit speculation as to what happened, why it might have happened, what can be done to correct it, and what can be done to prevent its reoccurence. Remember, your major roles are providing materials, preserving animal and student safety, and asking divergent questions to stimulate thought in the realm of possibilities rather than "correct answers". Whenever possible, relate the children's new experiences with this unit to more familiar land-oriented experiences. Maintain a classroom library and resource center of materials and tools to encourage the children to investigate independently.

Section I of this unit is a list of suggested questions for you to ask while you and your students are setting up the marine aquarium as described in "HELPFUL HINTS". These questions are meant to provide a focus for student observation and to stimulate the use of all of their senses to investigate.

Sections II and IV are each divided into five kinds of activities. We suggest that your room be structured with a center or area for each type of activity:

Center Name	Activity Type
Treasure Chest	Discovery
Explorer's Eye	Observing non-living things
Captain's Corner	Manipulating
Flipper's Fantasy	Pretending
Sea Dudes	Observing living things

Sections I through IV may be used in any order, however, the order of the activities within each section should be followed closely.

Draw up the portals and batten down the hatches! Have your students transform your classroom into a submarine preparing for a voyage to "inner space". You may enhance the illusion of a voyage by decorating your classroom windows as portholes and the door as a watertight ship's door. Divide your room into the five center areas mentioned above and designate one center to be used for story time (Book Locker). Once each new activity has been explored and discussed as a class, the materials may then be placed in the individual center areas for further investigation. You might encourage your students to keep a captain's log (verbal or pictorial) of their thoughts and feelings each day about their "marine" experience.

BY THE END OF THIS UNIT YOUR STUDENTS SHOULD BE ABLE TO DO THE FOLLOWING:

- better cooperate within groups
- better follow directions in handling animals
- make observations of marine materials and animals on the basis of number, size, shape, color, texture, smell and sound
- describe "marine" observations verbally or pictorially
- make guesses or inferences based on observations of marine animals and materials
- manipulate marine materials and make observations

Congratulations for deciding to place a marine aquarium in your classroom! With it the world of salt water will add another exciting dimension to your class studies.

HELPFUL HINTS

FOR

SETTING UP AND MAINTAINING A SALTWATER AQUARIUM

IN YOUR CLASSROOM

SELECTING THE TANK AND EQUIPMENT

Check your local pet store and explore its tanks and supplies. Tanks come in a variety of shapes and sizes. In selecting a tank remember that the larger the tank the easier it is to maintain but the more it costs. A ten gallon tank is certainly a good size for the classroom although, if you can afford it, a twenty gallon tank is better. The familiar rectangular tank comes in two styles, one greater in depth, and one with greater length. The lower, longer tanks are preferred because they provide more water surface area exposed to air and more bottom area important to the growth of beneficial bacteria.

Select an all-glass tank sealed with clear silicon sealant. One-piece plastic frames provide adequate support and do not rust. Check for a recessed ridge around the top of the aquarium which provides space for a plastic or plexiglass cover to cut down on splashing, evaporation, and the possible mischievous introduction of foreign materials.

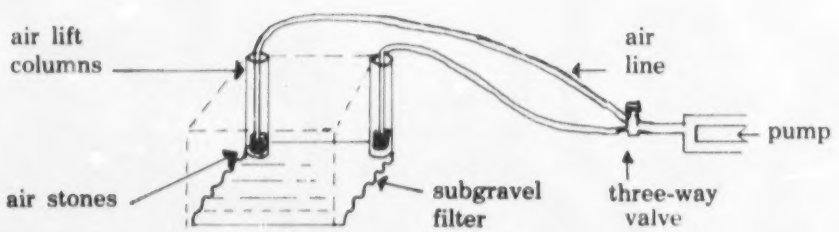
Fill the tank with water. If it leaks, return it. Do not try to fix it. If it seems to be leakproof, add a handful of non-iodized salt (available in most supermarkets) and allow it to soak overnight. Saltwater tends to loosen seals if they are not glued properly. If drops of liquid or salt crystals form along the edges of the tank, return it.

Dip out as much water as possible with a cup or a siphon and then carefully tip the tank to empty the remainder. Remember: never move a filled or partially filled tank. The seals and glass are not strong enough to support any shifting weight and can break as you are carrying it.

EQUIPMENT*

- 10 gallon tank
- lights and lid (can be added later or hand-made)
- subgravel filter, with air lift columns and air stones
- gravel (approx. 2 lb./gal. water)
- 1 pkg. Instant Ocean for 10 gal. tank
- small plastic net
- air pump
- air line (3 ft.)
- three-way valve
- thermometer
- hydrometer
- sponge
- large plastic tube to be used as a siphon

Note: If artificial plants are used, they must be made for saltwater aquarium use. Artificial plants for home use are not suitable because they may leach toxic chemicals into the water.

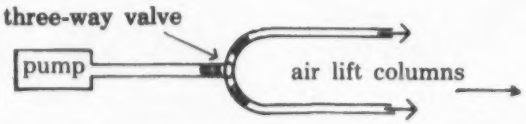


*Local pet stores as well as the pet departments of department stores carry this equipment. See Appendix A for a list of firms specializing in marine equipment.

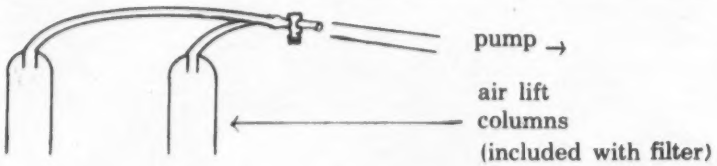
The perforated plastic plate that rests on the bottom of the tank is the subgravel filter. While supporting the gravel, the filter allows for circulation. It helps prevent stagnant areas where toxic substances develop. An airlift tube pulls water from the tank through the gravel where wastes are filtered out. Bacteria living in the gravel break down any organic material and prevent it from polluting the aquarium. Chemical balance will establish itself in an aquarium set up as described.

The air-flow system consists of an air pump, two air-lift columns, air line of appropriate diameter, and air stones.

The **three-way valve** controls the amount of air going into the tank from the pump. It is attached as shown:



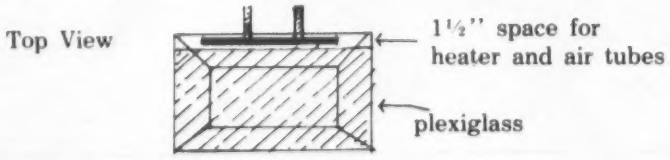
Spaces are provided on the filter for the attachment of the airlift columns. Attach airstones at the bottom of the stems inside the columns. The tubing is attached to the air pump by connecting air tubing to the tops as shown:



Gravel sold for use in a saltwater aquarium contains calcium. Limestone, crushed oyster shell, coral rock, or dolomite are some acceptable examples. The gravel will be somewhat uniform in size. Obtain enough gravel for a three inch layer on the bottom of the tank as well as a replacement supply. Students should rinse new gravel several times with tapwater until the wash water is no longer cloudy.

Heaters are selected according to the size of the tank. One is necessary only if the water temperature will drop below 15°C (60°F) even for a short period of time. Gradual slight temperature changes of 5° or 10° over a long period of time such as during winter school break usually do not cause problems. Sudden temperature fluctuations, however, are not easily adapted to by most organisms.

Covers are usually attached to the lights; such covers are expensive and not necessary for your classroom aquarium. A home-made plastic or plexiglass top that rests over the top of the tank is certainly adequate. This serves to reduce evaporation as well as to prevent the mischievous appearance of erasers and pencils in the aquarium.



Artificial sea water salts can be purchased at any aquarium supply store. Follow the directions on the package closely. Although natural sea water can be used, microscopic organisms or pollution in natural sea water can often contaminate the water; natural sea water is not recommended.

PLACING THE AQUARIUM

The setting in which you place your aquarium is important to the health of your animals as well as to its effectiveness as a teaching device.

1. A sturdy support system is necessary since sea water is quite heavy (a table, desk, or cinder blocks are fine). Once your aquarium is filled with water, it becomes a non-moveable fixture in your classroom. Do not attempt to move it once it has any water in it or you may break the seals or the glass.

2. Avoid direct sunlight; it will cause the temperature to fluctuate too much as well as to promote an excess of algae growth on the sides of the aquarium.

3. The aquarium should be placed in an area of fairly constant temperature, away from exits to the out of doors or open windows. A sudden change in temperature often leads to stress, disease, and the death in an aquarium.

4. The aquarium should be placed in a well-traveled area; this permits the fish to become familiar with external movement and makes them easier to observe and handle when necessary.

MAINTAINING THE AQUARIUM

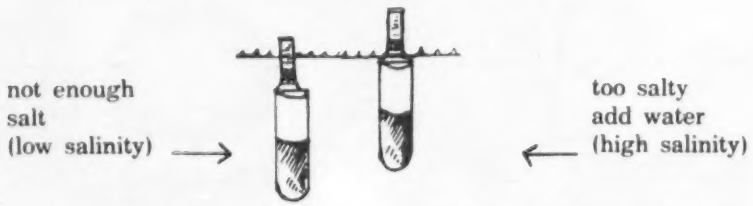
Daily:

Check to see that;

- pump runs smoothly - even bubbles adjusted by the three-way valve
- remove dead fish
- remove excess food
- check water temperature with thermometer; it should be between 20°-25°C (68°-77°F)
- wipe salt from outside edges of the aquarium

Weekly:

Check salinity by reading the number on the hydrometer where the water level crosses the scale (1.020-1.025). If the water level is below the desired scale reading, slowly add water. If it is above, slowly add sea salts and stir.



Clean inside front of glass by taking a clean sponge and wiping the glass gently. Never use soap or window cleaners. They will kill the fish.

Check and maintain the water level 5 cm (2 in.) from top of aquarium.

Monthly:

By siphoning or bailing the water out with a plastic cup or bowl, remove one-fourth of the aquarium water. The replacement sea water must be the same temperature and salinity as the water in the aquarium, so be sure to prepare it several days before changing the old water.

After a period of time (perhaps a month) algae will begin to grow on the bottom and sides of the aquarium. It tints the glass green or brown. This is not harmful to the animals, some of whom may eat algae. It also helps maintain the chemical balance within the aquarium. Remove it from just the viewing side of the aquarium by gently wiping a sponge or paper towel along the inside of the glass. Algae scrapers are available at pet stores.

Keep a supply of sea water on hand for use in student activities as well as for monthly maintenance. A well-rinsed milk jug with a plastic lid works well. Do not use a metal can or lid; it will rust and alter both the salt and metal content of the water. Follow the directions carefully on the artificial sea salt package.

SELECTING THE ANIMALS

Be sure that your aquarium is ready, allowing at least 48 hours (a weekend) for the temperature and salinity to stabilize before buying or collecting the animals.

If you are buying them from a store, here are some things to observe in purchasing them:

1. The colors of a healthy fish should be bright and clear.
2. Avoid fish with poor skin conditions, such as blemishes or white patches. This may indicate disease.
3. Rapid breathing or erratic swimming may also be a sign of disease.
4. Starving fish have a pinched belly behind the side fin as shown below.

5. Begin your aquarium with the least expensive animals that you can buy. Make sure that they survive before adding more exotic species.

FEEDING THE ANIMALS

Do not feed right away. Wait 24 hours. It is normal for animals not to feed for a day or two. If they don't eat the food within 15 minutes, remove it. Consult your local pet store for suggested favorite foods of your animals.

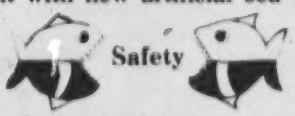
Fish like variety in their diets. In addition to dry flake food available from pet stores, you can feed your fish frozen shrimp, clams, squid, or mussels twice a week (these may be available as scraps from a local fish store). Place this food in direct contact with sea anemones, sea urchins, starfish, and sand dollars. Frozen and live brine shrimp are excellent for feeding most of your animals.

Some animals need to be fed twice daily, others need to be fed only every second or third day. Drop very small amounts of food in the aquarium. Wait until it is consumed before adding more. Watching an animal's behavior will quickly show you its requirements. Do not overfeed! Excess food will contaminate the water if allowed to decay; remove any large pieces of excess food. Overfeeding is a greater problem than underfeeding. Fish can go days or even a week without food (although this practice is not encouraged!)

HANDLING THE ANIMALS

Since you and your students will be handling and removing some of the animals from the aquarium for brief periods of time, non-fish animals such as starfish, crabs, shrimp, sea anemones, and sea urchins are recommended. They are very hardy. Some fishes such as blennies, toadfish, and mummichogs are more durable than others and can be used. Delicate tropical fishes require more care.

Handle the animals with nets whenever possible. When doing hands-on activities, be sure students rinse their hands thoroughly with water before touching the marine organisms. If you take water from the aquarium for such activities, replace it with new artificial sea water.



Remind the students before and during the lesson that the animals must remain in the water at all times unless carefully supervised by you. The children can touch them very gently to sense what they feel like and to watch their behavior.

To reinforce being gentle with the organisms, ask:

How would you feel if some one kept poking you and dunking you in the water?
How should we treat the animals when we observe them?

TREATING DEATH

Death is a natural occurance. When it occurs, discuss it. Let the students touch the animals and observe the changes after death.

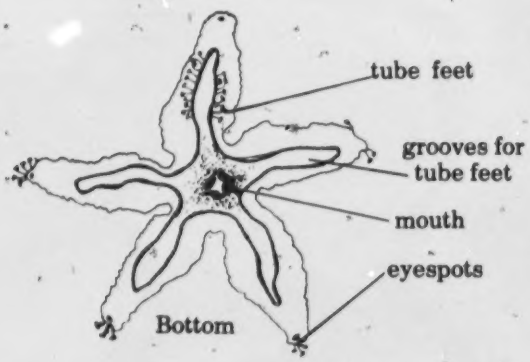
Remove dead animals and plants from the aquarium as soon as they are noticed. They decompose and release waste products which can upset the nutrient balance of the aquarium. Large natural bodies of water such as rivers, lakes, and oceans, can absorb wastes; however, an aquarium-sized tank cannot.

A BRIEFING ABOUT THE ANIMALS

Teaching Tip:

Don't rob your students from the thrill of discovery. The following information is provided only as an aide for your questioning. It is not intended to be presented to your class.

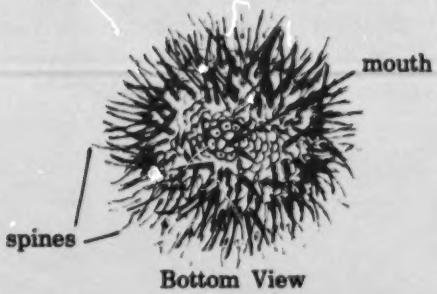
STARFISH



Starfish are popular spiny-skinned marine animals often found along jetties and piers. Upon careful examination, you will find tiny pin-points of red or purple at the end of each arm; these are "eyes". The "eyes" can only sense light and darkness. At the top of the animal is an orange spot which is filled with holes like a sieve plate. When magnified by a hand lens, it looks like a tea strainer. Water goes through this (straining out dirt and one-celled animals and plants) and into the starfishes' "water system". The water enters the tube feed, makes them swell, and helps the animal move slowly over rocks and other hard surfaces. If you turn a starfish on its back, it will right itself by using its tube feet.

The mouth is on the bottom in the center of the "star". A starfish feeds on large pieces of food by extending the lower part of its stomach through the mouth and enveloping the prey externally, much to the delight of students. The starfish eats shellfish such as oysters and clams by mounting the shell and clamping its arms around it. The "suckers" on the bottom of the tube feet attach themselves to the shells and rapidly pull them apart. The starfish then inserts its own stomach between the shells and digests its prey. In order to view the feeding process, place small pieces of food such as mussels, clams, scallops, oysters, or squid under the starfish.

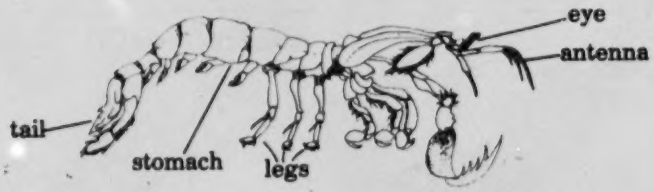
SEA URCHIN



Bottom View

The sea urchin is another of the spiny-skinnod marine animals that inhabits rock pilings and piers. Many of these creatures creep over the oozy bottom gorging themselves on bits of plant and animal material. In your aquarium they will often creep along the walls of the glass scraping bacteria and algae as they go. Like starfish they also move by throwing out tube feet and reorienting their hard spines, although the spines are used primarily for defense. The mouth is on the bottom and is surrounded by five pairs of teeth for scraping algae off rocks. They also have the power of regenerating spines when they are broken off.

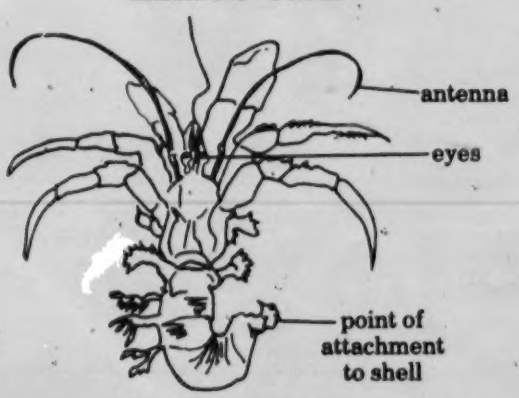
MANTIS SHRIMP



The mantis shrimp is an aggressive animal in an aquarium, burying itself under rocks and occasionally making shallow burrows in the mud. It can maneuver itself forward and backward and is quite adept at catching its prey. The mantis shrimp is a carnivore and a delicacy may be a bit of your finger. Be careful!

It has a grey-green plastic like outer skeleton with deep grooves separating different regions of the body. Green eyes mounted on narrow stalks are quite pronounced in the head region.

HERMIT CRAB*



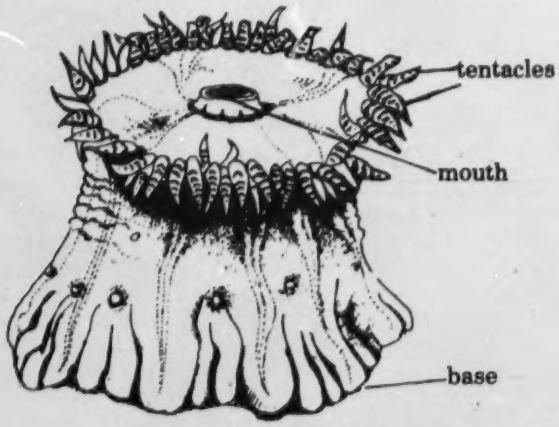
Hermit Crab out of Shell

Have you observed a snail's shell scurrying about at more than a snail's pace? Most likely, this is the "adopted" home of a hermit crab, a comical little animal that lives in the discarded shells of others.

*Warning: The hermit crabs sold in most pet stores live on land, not in the water. They are fun to watch and would be great to have in your classroom, but not in your aquarium.

Equipped with several pairs of walking legs and two front pincer claws, it scavenges along the bottom and climbs rocks in search of delicate morsels from the sea. At certain times of the year the hermit crab molts, losing its hard outer skeleton as its body grows. A larger crab requires a larger shell. The transfer to a new home is particularly exciting to watch in an aquarium. Just provide empty shells that are slightly larger than the one inhabited by the hermit crab and it will change shells when it is ready.

SEA ANEMONE

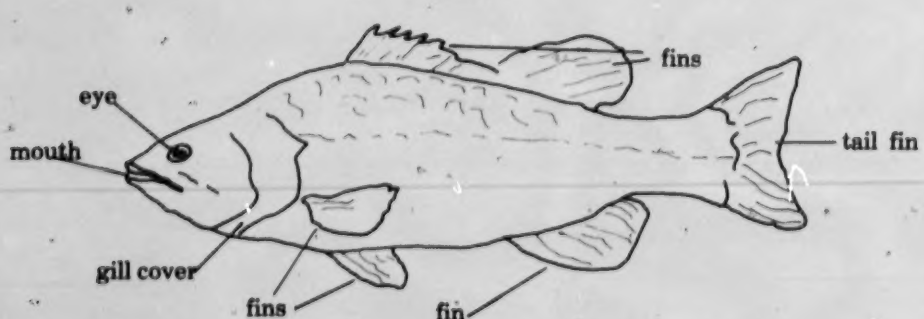


Anemones are the "flower" animals of the ocean. Tentacles surrounding the mouth open like petals and contract when danger threatens. They contain stinging barbs which temporarily paralyze their small prey and permit digestion to begin externally. They take food and dispose of wastes through a single body opening.

Some anemones are capable of swimming. Others depend upon a muscular disc on the bottom of their bodies to creep over rocks and sand. This disc also enables them to "hitch-hike" on shells of other animals.

Sea anemones are carnivorous. There are some that collect particles of food from the water while others must have food placed in direct contact with tentacles. Acceptable diets consist of fresh or frozen shrimp, crabs, mussels, or fish meat. Food must be placed in direct contact with the tentacles. Any uneaten food should be removed from the aquarium. They should only be fed when all of the tentacles are out.

FISH



Fishes are animals with backbones that live in the sea. Fast swimming fishes usually swim by undulations of the body. Most slow-moving forms move principally by moving their fins.

In most fishes, the water (in which oxygen is dissolved) is pumped in at the mouth by movement of the bony gill cover and flows out across the gills. The fish can regulate the rate of flow by opening and closing its mouth.

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Fish are vulnerable to physical handling and changes in water temperature and salinity. Rapid gill pulsing and sporatic body movements may be physical signs of such stress.

Different fishes feed in a variety of ways. Some, such as blennies and hogchoakers, scavenge and scrape the bottom for small morsels. Others capture their prey alive while swimming near the surface.

A PARTING LINE

The first section of the unit will be the most difficult if both you and your students are setting up a salt-water aquarium for the first time. Don't shelter your students from the frustration of learning by trial and error or from the joy of successfully mastering a real problem. Although your children may not be able to verbalize some of the physical properties involved, active intellectual and physical involvement in the experience of setting up and observing a saltwater aquarium will provide the basic experience upon which formal definition and principles can be built when the child is ready.

FOR FURTHER INFORMATION

Several of the ideas in this section were drawn from the following books, You may wish to consult them for more details on aquarium set-up and maintenance.

Spotte, Stephen. 1973. Marine aquarium keeping: the science, animals and art. John Wiley and Sons, New York. 171p.

Emmens, C.W. 1975. Marine aquarium in theory and practice. THF, Neptune City, New Jersey. 208p.

CALENDAR

Estimated Total Time For Unit Approximately 3 or 4 Weeks

SECTION [Estimated Time]	INSTRUCTIONS	WHEN
Pre-unit Activity	Order Films (See Appendix C) and locate books noted at end of Sections	2 to 3 months ahead
	Read Introduction: Buy or collect materials - Aquarium supplies and rocks, shells, and sand	1 week ahead
Section I (20-30 min. per day for 1 week)	Do All Activities Start Captain's Log in first discussion	After setting up allow 48 hours before putting any animals in aquarium in Section II
	Prepare boxes for Section II and buy or collect marine specimens	1 or 2 days prior to starting Section II
Section II (3-30 min. periods)	Do All Activities Update Captain's Log Read "A SEA FANTASY" (Appendix D) to class	Daily In Conclusion
	Prepare boxes for Section III	2 days prior to Section III
Section III (3-30 min. periods)	Do All Activities Update Captain's Log Prepare Materials for Section IV	Daily 1 or 2 days prior to Section IV
Section IV (3-30 min. periods)	Do All Activities Update Captain's Log Get materials for Section V	Daily 1 or 2 days prior to Section V
Section V (2-30 min. periods)	Evaluation	

SECTION I

SETTING-UP

(estimated class time: two or three hours)

Processes: Observing, Hypothesizing **Content:** Setting up a saltwater aquarium

Teaching Tips:

Section I is an introduction, intended to increase awareness, interest, curiosity and speculation about the world of water, i.e. the nature of water and the animals that live in it. As fuller exploration of student ideas of water and organisms will be provided in subsequent sections, don't try to reach conclusions at this point. As you set up your aquarium, use as many of the suggested questions as you wish (adding your own) to stimulate discussion.

- ten gallon tank (glass)
- lid (see cover section of the introduction)
- sub-gravel filter, with air lift
- columns and air stones
- gravel (approx. 2 lb./gal.)
- 1 pkg. artificial sea salts (ten-gallon size)
- small net
- a goldfish in a jar of water
- small cups
- funnel
- cotton batting
- air pump
- air line tubing (3 feet)
- three-way valve
- thermometer and hydrometer, preferably plastic (may be borrowed from a high school science dept)
- quart size clear container of water
- quart size clear container of salt water
- pictures of bodies of water (lakes, rivers, oceans)*
- pictures of water being used*

Preparation for Class:

Gather the materials listed above. Select the tank and check it for leaks according to the directions on page 2 of HELPFUL HINTS.

Put the goldfish in a container. Feed once a day. By the third day stools should be visible. This provides the background for Part 5 of this section.

*If available

SUGGESTION FOR DISCUSSIONS

Water and Salt Water

Begin the introductory discussion by placing a clear jar of tap water and a clear jar of sea water (salt water) in front of the children. Have the children examine the two jars of water. Ask lots of questions. Those listed here are just a few for you to start with. In the discussion, stress that ocean water is salty whereas tap water is not.

What can you tell me about the water in these jars?
Is the water in both jars the same?
Is it hot?
How could you tell?
Do both jars of water smell the same?
What does it taste like?
How could you tell? (Let each student taste difference.)
What color is the water?
The water in one jar is fresh water that can be used for drinking.
Which one is it?
The water in one jar is ocean water. Which one is it?
Does it taste like drinking water?
Have you ever seen water outdoors?
Where? (Pictures could help build or focus discussion)
What things live in water?
How can we find out about the things that live in water?
How can we make noises with the water?

Bring in the empty aquarium and ask:

Can you guess what might live in our aquarium?
Would things that live in the aquarium grow?
What would things that live in an aquarium look like?
How big would they be?
Would they move? How?
How many do you think could live in the aquarium?

Needs

These questions with the empty aquarium in front of you are meant to encourage thoughts and feelings about the needs of things living in water as you begin to set up your classroom aquarium. To provide focus for the discussion of needs, a 30¢ goldfish in a container would be a useful prop. This conversation may be used to make an assessment of your students' present knowledge.

What kinds of things do we need to do to the aquarium if we want something that lives in the ocean to come live in our classroom?
Can they also live in a cage? On a desk? In our hands?
Why?
What things do we need to live?
(food, clothes, air, shelter, sleep, etc.)
Are the needs of fishes the same as ours?
How are they the same?
How are their needs different?
Why?
Why is it nice to have an aquarium in our classroom?
Who is going to take care of the aquarium?

Locating the Aquarium

Discuss with your students the placing of the aquarium in your room. (For background information for this discussion see page 3 of HELPFUL HINTS.)

Where should we place our aquarium?
Why?
Should we place it near a window?
Should we place it in front of the door?
Should we place it on the floor?
Should we place it in the hall?
Should we place it in the cupboard?
Suppose you were a fish, where would you want the aquarium?

Container Properties

Besides the aquarium what else could we use to hold water?
Is a paper box or bag okay?
Why?
How about a jar?
Why?
What would be the best container?
Why?

Wastes

As you and your students assemble the bottom filter and air-flow system as diagrammed and described on page 2 of HELPFUL HINTS, use the suggested questions and auxiliary activities below as a basis for discussion.

Examine the water that the goldfish is in. Stools should be visible.

Do living things in the oceans and rivers have to go to the bathroom just like you and I do?
Where do these wastes go?
How would it feel to swim in dirty water? To drink dirty water?

Put a small amount of the water that the goldfish is in into another container. Place the goldfish in the new container and ask:

How can we take the wastes out of the water that the goldfish was in?
Why do we want to keep the water clean?
What can we do to keep the water clean?

Bottom

Place cotton batton in the bottom of the funnel and filter the water as shown below. Have the children examine the cotton.

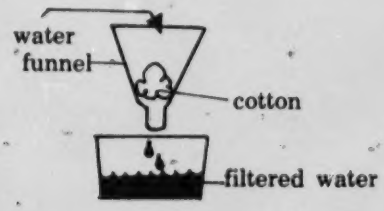
What did the cotton do?

Place the water and goldfish back in the original container.

Would you rather swim in the water before or after it went through the cotton?

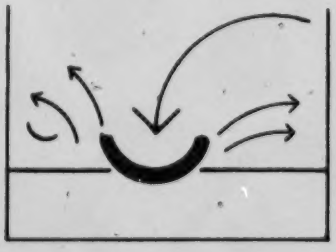
Have your students rinse the gravel with tapwater several times until the wash water is no longer cloudy. Do not use soap or any other type of cleaner. Let the students scoop cupfuls of gravel and carefully place them into the tank until there is an even three inch layer over the subgravel filter.

How does the gravel feel? Smell?
What color[s] is the gravel?
What kinds of sounds can you make in the gravel?
How would you feel if you lived in the gravel?
Why?
How would you move? Get your food?
Can water go through the gravel?
Is each piece of the gravel the same size?



Water

In order to prevent stirring the gravel while pouring in water, place a bowl on top of the gravel in the tank. Have class members pour the tap water into the tank until the water level is approximately 5 cm (2 in.) from the top of the tank. This is a "working" aquarium and this space allows room for the children to remove animals and plants without having the water overflow.



Why are we pouring water into the tank?
Can we put in dirt instead? Why? Sugar? Why?

Put the hydrometer in the unsalted water. See HELPFUL HINTS, page 4, for directions in using a hydrometer.

What do you see?
What else do we have to put into the water in order for it to be like ocean water?

Sea Salts

Add artificial sea salts according to the directions on the package.

Where did the salt go?
Why can't we see it now?
Why did we put salt in the water?

*Put the hydrometer in the tank.

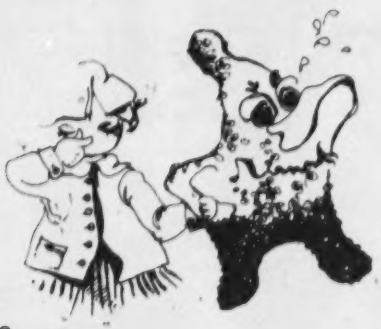
What do you see?
Is it the same or different from before?
Why?

We use a hydrometer to measure how much salt is in the tank.

Why would we want to know how much salt is in the tank?
How does the water taste?
Would you like to drink a lot of it?
Did the salt make the water smell, look, or feel different?
Can we use sugar instead of salt?
Why?
Would you like to live in saltwater?
How would it feel different from living in air?

Air

Have the children hold their noses with their hand over their mouth for ten seconds.



Do you have trouble?
Why?

We breathe by taking in new air and breathing out old air.

Where does new air get into the water?
Where does old air get out?
How does a fish breathe? [Look at the goldfish]
Does water on the bottom of the aquarium get as much air as water on the top?
What can we do to make the water on the bottom of the tank move up to the air? [Air bubbles in the subgravel filter columns do this.]

Hook up the pump and adjust the gang valve as directed in the introduction.

What do you see? Hear? Feel?
How does the pump change the water?

Your classroom aquarium is set up. Do not place any animals in it for forty-eight hours. This allows time for the salts to dissolve and the temperature to stabilize. Continue with activities of Section II during this time.

Captain's Log:

Have your students record their experiences and any changes that they observed in the water as well as any adjustments that they had to make. This information may be represented pictorially. Here is a chance to use the calendar information taught in most classes.

Date	Observations
Monday, Oct. 1	

Who is coming?
Can you draw who you think will come live in our aquarium?

This activity may be done individually, or as a class mural, using crayons or paint.

SECTION II

SAND AND CRABS!

(estimated class time: two or three 30 minute sessions)

Processes: Observing, Counting, Recording

Content: Color, Size, Shape, Number, Sounds, Texture

- plastic or oil cloth to cover tables
- six shoebox-sized boxes
- masking tape
- magnifying glasses
- magnets
- screens, tweezers, spoons (if available)
- gravel
- sand
- three clear, wide-mouthed containers (5-6'' deep)
- three crabs (Hermit* or otherwise)
- water
- glue

Teaching Tip:

When the materials are being explored as a class, prior to their placement in an interest center, divide the class into three groups. Give each group a marine-oriented name (Examples: sharks, snails, starfish, etc.) which they will keep throughout the unit. Consistent grouping as well as group names might serve to inspire some group identity.

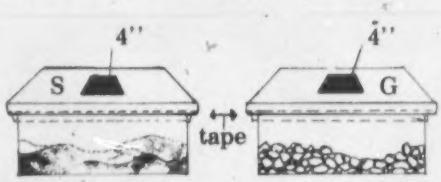
In order to identify the groups, have your students make undersea animal name tags for themselves.

Preparation for Class:

Line the bottom of the shoeboxes, three labeled S and three labeled G, with plastic or aluminum foil. Put gravel in three of the boxes and dry sand in the other three boxes. Cut a hole 4'' x 4'' in each of the boxes and seal the edges of the cover to the box with tape.

Treasure Chest:

Divide your class into three groups and give each group an S box and a G box. Have your students poke their hands into the holes of each of the boxes and ask them some of the following questions (add others as appropriate) in order to encourage careful observation:



*Pet Store Hermit crabs live on land, not in water. See page 4 of HELPFUL HINTS for tips on buying animals and see Appendix B for a list of marine life suppliers.

How does each material feel? Smell?
What did you use to find out?
Does the material in both boxes feel the same? Different? How?
Does it feel rough or smooth?
Would you like to walk on it in your bare feet?
Does the stuff inside feel like anything that you have ever felt before?
Is all of the material the same size? Shape? Color?
How can or did you find out?
How many sounds can you make in each box?
Are the sounds the same in each box?
What did you use to hear the sounds?
Do the materials smell the same?
Could you count the number of pieces of stuff in the box?
Can you guess what is inside the boxes?
How can we find out for sure?
Which box is heavier?

Explorer's Eye:

For each group of students place ½ cup each of sand and gravel on two separate plastic trays or boxes. Provide magnifying glasses, magnets, tweezers, spoons, and screens for each group of students.

What can you tell me about the materials?
What part of your body did you use to find out?
Which material has bigger pieces?
How does the sand and gravel look the same? Different?
What colors can you find in the materials?
Is it all the same shape?
Are the materials like anything that you have ever seen before? Where?
Which material would you rather play in?
What happens when you put a magnet over the materials?
Does anything happen?
What other things stick to the magnet?
Can you match these materials with the things in the boxes in the treasure chest?

Captain's Corner:

Ask the following questions for sand and gravel to encourage handling the materials. This activity would best be done on trays or in a large water-proof container.

How can we change the size, shape, color of the_____?
Can you make something from the_____?
What can we use to hold the_____together?
What does water do to_____?
Would wet or dry_____be better for building a play castle?
Does it look different? Feel different?
What kinds of sounds can you make in the_____? In wet_____?
Are the sounds the same? Different?

Some children may suggest using paints, glue, or other materials found in the classroom. Be adventuresome.

Should someone want to pound the materials with a hammer, be sure to cover the material so that it won't fly up into his eye.

(a whole class creative expression lesson)

Flipper's Fantasy:

Pretend that you are an animal that lives in the sand or gravel.

How big would you be?
What would you look like?
How would you move through or over the material?
Can you make your body move like that?
What kind of home would you build?
How would you build it?
How would you hide from other animals who might want to eat you?
How would you get your food?
What would your food be?

Sea Dudes:

Before doing this activity, see page 5 of HELPFUL HINTS for instructions on safety and handling.

Teaching Tips:

If you are using salt water hermit crabs they must be slowly acclimated to the aquarium water since it will be slightly different in temperature and salinity than their transporting water (from the pet shop or natural waters). Therefore, for each group of students, prepare a small, clear wide-mouthed container with a small amount of transporting water and ¼" of aquarium water. Have the students gradually acclimate the animals by adding a small amount of aquarium water (¼ cup every ½ hour for 1-1½ hours) to the individual containers.

Does the crab look like you and me?
How is it the same? Different?
How does it feel?
Does it feel the same all over?
Is it rough or smooth?
Does the crab have a top and a bottom? Front and back?
How can we find out?
How are they different?
What does it do that we do?
How many ways does it move?
Eat?
Can you pretend to walk like a crab?
How many eyes does the crab have?
How many legs does a crab have?
Are they all the same?

What colors do you see on the crab?
Does the crab have arms? A neck? Hair? Toes? A mouth?
Does it look the same through a magnifying glass?
What would be a good name for our crab?
In what ways are all the crabs the same?
In what ways are all the crabs different?

Give the students plenty of time for observing and "messing about" with their new friends.

Captain's Log:

As part of their Captain's Log, have the children keep a chart to record and compare observations about their "Sea Dudes". The children can record their observations by illustrating them or they can record their data by circling their observations on a record sheet like the following:

animal moves	yes	no	???
has legs	10 9 8 7 6 5 4 3 2 1 0		
has eyes			?
seems happy			???
hears sounds			?? ??
is usually found			

When the activity is finished: –

Supervise the placing of the animals and plants that you have in the aquarium. (Dip the container with the animals into the aquarium sideways and let the animal or plant flow out with the water.)

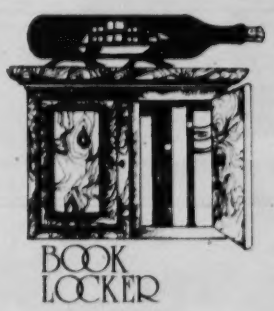
Art Activity:

Have the students dye the sand and gravel with food color or water color. Make designs or pictures by putting glue or paste on cardboard or heavy paper. Sprinkle sand or gravel on the paste or glue. Let it dry. Lift the picture and let the excess sand or gravel fall off.

Finger Games

Make a loose fist with one hand. Place the index finger of the other hand through the hole.

"Here is a home for a crab to hide.
Until a worm peeks inside."



Ardizzone, Edward. **LITTLE TIM AND THE BRAVE SEA CAPTAIN.** Henry Z. Walck.

Ardizzone, Edward. **TIM AND LUCY GO TO SEA.** Henry Z. Walck.

Ardizzone, Edward. **TIM TO THE RESCUE.** Henry Z. Walck.

Selsam, Millicent. **SEA ALONG THE SHORE.** Harper and Row.

Selsam, Millicent. **BIRTH OF AN ISLAND.** Harper and Row.

Lionni, Leo. **THE BIGGEST HOUSE IN THE WORLD.** Pantheon.

Lionni, Leo. **SWIMMY.** Pantheon.

Golden, Augusta. **THE BOTTOM OF THE SEA.** Thomas Y. Crowell, Co.

Yashima, Taro. **SEASHORE STORY.** Viking Press.

SECTION III

ROCKS, SHELLS, AND STARFISH

(estimated class time: two or three 30 minute sessions)

Processes: Observing, Counting, Comparing

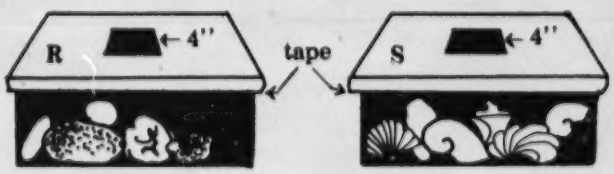
Content: Color, Size, Shape, Number, Sounds, Textures

- plastic or oil cloth to cover tables
- shoeboxes from previous section
- small rocks - collected outside
- shells (clams, oysters, snails, crabs) - available from restaurants
- magnifiers
- magnets
- four clear wide-mouthed containers (5-6'' deep)
- starfish (alive)
- six boxes (shoe-box size)

Preparation for Class:

Divide the class into their original groups.

Label three shoe-box size boxes R and three, S. Place four or five rocks in each of the boxes labeled R. Place four or five shells in the boxes labeled S. Cut a hole 4'' by 4'' in the lid of each of the boxes. Seal the edges of the covers with tape as shown below.



Treasure Chest:

Have your students put their hands through the holes into each of the boxes. Use the following questions, or any that you generate, to encourage careful observation and discussion.

How do they feel? Smell?
What did you use to find out?
Do the objects in the boxes feel the same? Different? How?
Are they rough or smooth?
Do they feel like anything that you have ever felt before?
How many sounds can you make in each box?
Are the sounds the same in each box?

What did you use to hear the sounds?
Which box contains something that is easier to hold on to?
Why?
How many pieces can you count in each box?
Are the objects in each box the same size? Shape?
What shapes are they?
Are they the same on all sides?
Do they have edges?
Are the edges sharp?
What colors are the objects?
How can you find out?
Do you know for sure without opening the boxes?
Why?
What do you think is inside the boxes?

Explorer's Eye:

Have your students place one object from each of the two boxes used in the Treasure Chest Activity onto a plastic covered table. Provide magnifying glasses and magnets for each group of students.

In what ways do they look the same? Different?
Which object is heavier?
How many colors can you find?
Are they both the same size? Shape?
Are the objects like anything that you have ever seen before? What?
Are they rough or smooth?
Which is rougher?
Which is smoother?
Are they hard or soft?
What happens when you place a magnet over the objects?
Does anything happen?
What things stick to a magnet?
Would the objects float or sink?
How could you find out? (Try it.)
Could an animal use either of these things? How?
Where would you go to find each of these objects?

Captain's Corner:

Ask the following questions for rocks and shells and encourage the handling of materials to find answers.

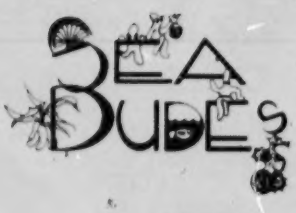
To prevent flying chips, rocks and shells should be covered with material if they are to be struck.

How can we change the_____?
Can you build something with the_____?
Is it easier or harder to build with sand?
Why?
Can you make something from the_____?
What can we use to hold the_____together?
What does the water do to the_____?
Does it look different? Feel different?
What kinds of sounds can you make in the_____?
In wet_____?
Are the sounds the same? Different?
How many pieces can you use to build something?

Flipper's Fantasy:

This activity may best be carried out together as a class as part of a creative expression lesson.

What if you were an animal living in the rocks? Shells?
How would you move from one place to another?
What kind of home would you build?
How would you hide from other animals who might want to eat you?
How would you get your food?
What would you look like?
How would you look [eat, move, or hide] differently than an animal who lives in the sand and gravel?



Sea Dudes:

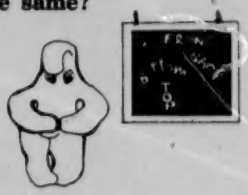
See pages 4-6 of HELPFUL HINTS for instructions on safety and handling.

Teaching Tips:

Animals must be slowly acclimated to the aquarium water since it will be slightly different in temperature and salinity than their transporting water (for each group of students, prepare a small, clear wide-mouthed container with one cup of transporting water and ¼ cup of aquarium water. While the students are doing this activity, you will be gradually acclimating the animals by adding a small amount of aquarium water (¼ cup every ½ hour for 1-1½ hours) to the individual containers, so that the starfish can be safely placed in your aquarium at the end of the activity.

Does the starfish look like you and me?
How is it the same? Different?
What does it do that we do?
How many ways does it eat? Move?
Can you pretend to walk like a starfish?
How does the starfish hold on to things?
Can you make it move in different ways?
What color[s] is it?

Does it have a front and back? Top and bottom?
How do you know?
Does it feel the same all over? Is it rough or smooth? Soft or hard?
How many arms can you count on the starfish? Are they all the same?
Can the starfish see?
How can you find out?
Do you know for sure?
What does it like to eat?
How is the starfish like the crab? Different from the crab?
Is the starfish bigger or smaller than the crab?



You might include sea urchins and sea anemones in this "Sea Dudes" section as well.

Captain's Log:

Have your students add their daily "sea" thoughts or feelings (in words or pictures) to their log.

Puppets or Mobiles

- construction paper
- stapler
- cotton for stuffing (newspaper is adequate)
- stick (twigs and fallen branches from a tree work well)
- sand, shells, crayons, or paint for decorating the outside of puppets
- string for mobiles

Draw and cut duplicate shapes of some aquarium animals out of construction paper. Have your students color and paste objects on the outside before stuffing.

How can we make our stuffed animals look and feel like our real aquarium animals?

Staple the duplicates together around their edges, leaving a two-inch hole on the bottom for stuffing with cotton, and for placing a stick or stapling a string (for a mobile).

Classifying

Small objects such as buttons, pebbles, rocks and shells, sticks, and paper are grouped and sorted by the children. Ask your students to construct a textured picture or design by pasting the objects on cardboard or wood. Stress a repeated pattern and keep the pictures small to avoid boredom.

Body Games

Starfish arms come in five, They creep, they eat, they curl aside.	Hold up 5 fingers, make them creep and curl aside.
Starfish grab a clam real tight - They hold and tug with all their might.	Make a fist with one hand and wrap the other hand around it.
Like a flower it seems to be, The anemone wants to dance with me.	Stretch arms out and wrap them around your shoulders.
It reaches high and bends about To catch some food without a doubt.	Stretch arms out real high and bend them about.

Wyps, Max Abbert. **MAGIC OF THE SEA** (Viking Press)

Jenkins, Marie. **MOON JELLY SWIMS THROUGH THE SEA** (Holiday House)

SECTION IV

WATER, FISHES, N'THINGS

(estimated class time: two or three 30 minute sessions)

Processes: Observing, Inferring, Manipulating **Content:** The properties of water and fishes.

Divide the class into their original groups in preparation for their first experience with the materials of this section.

- plastic to cover tables
- pint size jars
- food coloring or instant colored drink
- table salt
- sugar
- magnifiers
- vinegar
- sand
- shell
- 4 wide-mouthed containers (5 - 6" deep) clear or plastic food containers work well as long as they are thoroughly cleaned
- fish

(If jar of water is to be heated in Captain's Corner)

- pyrex glass container
- hot plate

Preparation for Class:

Prepare the following. Place the same volume in each of the six pint-size jars:

A. Water and 6 tbs. salt (unstirred)
B. Water and 6 tbs. sugar (unstirred)
C. Water and 6 tbs. instant drink (unstirred)
D. Water
E. Water and a shell
F. Water and a rock

Tape black paper completely around the sides of the labeled jars so the children cannot see the contents.

Treasure Chest:

Do any of these jars have the same thing inside?
How can we find out without looking?
Do any feel the same? Smell the same?
Do they taste the same? Different?
Do they make the same noise when shook gently?

Explorer's Eye:

Remove the black paper from each jar. Have the students feel dry salt, dry sand, and dry sugar.

How are they alike? Different?

Add salt to saltwater (Jar A). Add sugar to sugarwater (Jar B). Add clean sand to plain water.

Observe.

Do the sand, salt and sugar float?
Why?
Did it change color?
Is anything happening to it?

Stir it.

What happened to the sand? Salt? Sugar?
Now which are alike? Different?
Does the water that looks alike taste alike?
How many colors do you see?
Which jar has the most water [liquid]?

Put a shell in a jar of vinegar. Put a rock in a jar of vinegar. Shake daily and observe each over a period of a week or two.

Captain's Corner:

Ask the following questions for water and salt water. To encourage handling of the materials, do as many activities suggested in your students' answers as you can.

Can we make water change in different ways?
Can you make it change faster or slower? How?
Can we make the water feel different? Smell different?
Taste different? How?
Does water make any sound?
Can we make it make sound?
When you heat (cool) the water does it change?
Does the amount of water change when you boil it?
Can water make things change? (Hint - salt) How?
What does salt do to things?
Does it make things look, smell, taste, feel or sound different?

Flipper's Fantasy:

This activity may best be carried out together as a class as part of a creative expression lesson.

What would you do if you were an animal living in the water?
How would you move through the water from one side of the aquarium to the other?
What kind of home would you build?
How would you hide from other animals who might want to eat you?
How would you grab your food?
What would you look like?
Where would you find food?
What kind of food would you eat?

Sea Dudes:

See pages 4 - 6 of HELPFUL HINTS for instructions on the safety and handling of aquarium animals.

Preparation for Activity:

Animals must be slowly acclimated to the aquarium water since it will be slightly different in temperature and salinity than their transporting water (from the pet shop or natural waters). Therefore, for each group of students, prepare a small clear wide-mouthed container with one cup of transporting water and ¼ cup of aquarium water. While the students are doing this activity, you will be gradually acclimating the animals by adding a small amount of aquarium water (¼ cup every ½ hour for 1½ hours) to the individual containers, so that they can be placed in your aquarium at the end of the activity.

Does the fish look like you and me?
What does fish "skin" look like?
How is it the same or different?
How many eyes does it have?
Is it the same on all sides?
Is it rough or smooth?
How many colors? Front and back?
Are there any stripes or spots?
What does it do that we do?
Does it breathe?
Does it have teeth?
How many ways does it move?
Can you count the scales?
Does it stay near other animals or does it hide?
Does it play with the other fish?
Does it try to bite other fish?
Can you pretend to move like a fish?
How is the fish like the crab or the starfish?
How is it different?

You might include several (not more than three) different kinds of fishes.

Captain's Log:

Have your students continue to record daily:

-salinity and temperature of the aquarium water
-observations of "sea dudes"
-"sea" thoughts and feelings

When the activity is finished:

Supervise the placing of the animals and plants in the aquarium.

Feelings in Paint

- fingerpaint
- construction paper or newsprint

Procedure:

Have your students paint what they are feeling while listening to underwater sounds or music.

Fish Printing

Gyotaku, the Japanese word for fish printing ("Gyo" means fish, "taku" means print) was started in China over 600 years ago as a means of recording fish catches. It was developed into an art form by the Japanese.

Fish printing is a relatively easy activity for children. It is not expensive.

This activity is a good way for children to investigate different parts and textures of a fish.

- playdough
- a dead fish
- ink (india, speedball, acrylic, watercolors, tempera, finger-paint, etc. - choose one)
- paper (paper towels, rice paper, construction paper, etc. - choose one)
- small paint brush
- newspaper

Procedure

1. Paint will not stick to a slimy fish. Wash the dead fish well with soap and dry it.
2. Place the fish on a layer of newspaper. On the underside of the fish use playdough to spread out the fins and tail and to keep the fish from sliding off the newspaper.

3. With a small brush gently paint one side of the fish with ink. Make sure all areas are covered including the fins. Use very little ink. Brush against the "grain" of the scales so ink will accumulate in these areas and make a better print. Most people use too much ink the first time so you will have to experiment.

4. Take paper and gently but firmly press down on fish. Rub evenly over all areas, especially head and fins. Do not move paper while pressing.

5. Carefully lift paper up making sure the fish does not move. This will smear the print.

Various papers and inks can be used.

Fish can be washed and reused. Generally, the thicker the ink and thinness of paper, the better the print.

Finger Play

A fish swims by, real slowly and smoothly
Just one way they like to move.

Place two hands together, wiggle them together.

Lionni, Leo - **FISH IS FISH** Pantheon Press.
Wildsmith, Brian - **FISHES.** Franklin Watts, Inc.
Cartwright, Sally - **THE TIDE.** Coward-McCann
Hawes,, Judy - **WHY FROGS ARE WET.** Thomas Y. Crowell Co.

SECTION V

EVALUATION

(estimated class time: two 30 min. lessons)

Teaching Tips:

This section should be done in as informal a manner as possible. It is designed to give feedback to you, the teacher, rather than to grade students' achievement.

- animals from aquarium
- wooden blocks
- animal (new to children)
- picture of sea organism

A. **Objective:**

1. To follow directions in handling animals from the aquarium.
2. To cooperate within groups.

Evaluation:

Divide your class into the groupings used in this unit. Give each an animal from the aquarium in a small jar of aquarium water.

What can your group tell me about your animal?
How can you get your animal to move to one side of the jar?

Carefully observe your students working together as groups. Look for a sharing of ideas and materials as well as proper handling of animals and equipment.

B. **Objective:**

To make observations (verbally or pictorially) on the basis of number, size, color, shape, texture, smell, and sound.

Evaluation:

Present a new animal (preferably one for the aquarium) to the class and ask some of the following questions:

Tell as many things as you can about_____.
How is it the same or different from other animals in the aquarium?
How is it like us?
How is it different?

Can you count the eyes? Legs?
How many colors does it have?
What are they?
Is the top the same as the bottom?
Does it feel like anything you have ever felt before?
Does it make any sounds?
Can you make the same sound?

C. **Objective:**

To make predictions or guesses based on observations of new and old animals.

Evaluation:

A picture of an animal may be used here instead of another live animal.

How do you think it might move? Eat?
Which other animal in the aquarium do you think this will act most like?
What do we need to take care of the animal?
How does it protect itself?
Why?
How do you think it eats?
Why?
Where do you think it might live?
Why?
Can you pretend to move like the animals in sand? Over rocks?
In the water?

D. **Objective:**

To manipulate materials in order to make different observations.

Evaluation:

Give each child a block and then ask:

How many sides does this block have?
Are all of the sides the same color?
How many colors can you count on the block?
Are all of the sides the same size?
Do all of the sides feel the same?
Would you build something from the blocks?

APPENDIX A

AQUARIUM SUPPLIES

Aquarium Stock Company
27 Murray Street
New York, NY 10007

Aquarium Systems, Inc.
1450 East 289 Street
Wickliffe, OH 44092

Coral Reef Exhibits
Box 2214 AMF Branch
Miami, FL 33159

Hawaiian Marine Imports, Inc. Co.
465 Town and Country Village
Houston, TX 77024

Norfolk Neptune Wholesalers
1922 Colonial Ave.
Norfolk, VA 23517

Ocean Odyssey
9444 Main Street
Fairfax, VA 22039

Pacific Marine Imports
5420 W. 104th Street
Los Angeles, CA 90045

World-Wide Aquarium Supply
2899 Norstrand Ave.
Brooklyn, NY 11229

APPENDIX B

MARINE LIFE SUPPLIES

Carolina Biological Supply Co.
2700 York Rd.
Burlington, NC 27215

General Biological Supply House
Turtox
8200 South Hoyne Ave.
Chicago, IL 60620

Gulf Specimen Co., Inc.
P.O. Box 237
Panacea, FL 32346

Marine Biological Laboratory
Woods Hole, Mass. 02543

Northeast Marine Specimens, Co., Inc.
P.O Box 1
Woods Hole, Mass. 02543

APPENDIX C

BOOK PUBLISHERS

Coward-McCann
200 Madison Ave.
New York, NY 10016

Thomas Y. Crowell, Co.
10 E. 53rd Street
New York, NY 10022

Franklin-Watts Inc.
730 5th Ave.
New York, NY 10019

Harper and Rowe Pub., Inc
10 E. 53rd Street
New York, NY 10022

Pantheon Books
Division of Random House, Inc.
201 E. 50th Street
New York, NY 10022

Viking Press
625 Madison Ave.
New York, NY 10022

Henry Z. Walck, Inc.
Div. of David McKay Co.
Promotion Dept.
750 Third Ave.
New York, NY 10017

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APPENDIX D

A SEA FANTASY

Teaching Tips:

This story should be used as an extension of any one of the Flipper's Fantasy sections of a Chapter. The following questions and facts may be useful in helping your students sort out fact from fantasy.

Can clams and crabs really talk?
Can clams think and tell stories like you and me?
Would crabs and clams really help each other?
Do clams really know their uncles?

Facts:

Clams live in deep water not usually disturbed by wave action.
Mole crabs live in the sand in the surf zone, and are well adapted to the constant wave action.

Starfish do "attack" and eat clams as described in the story.
Most clams live by themselves in mud or sand.

Enrichment Activity

THE ADVENTURES OF HAPPY THE CLAM

by Steve Fisher and Ellen Odell-Fisher

Once upon a time there was a spunky young clam by the name of Happy. Happy lived in the ocean with his friends out from the beach beyond where the waves break. He and his friends lived in small caves called burrows beneath the ocean floor. And it was as snug as snug could be for a clam. Clams have to make their homes beneath the ocean floor, or during big storms, rushing waves and moving sand would wash them away. Clams, as you can see, are not at all like fish. They can't swim, so it is important that they have a home where they rest safely away from the stormy ocean and strong currents.

Happy, like any other clam, loved burrows. He and his friends would lie there and listen to the noise of the waves above them. They called the noise the music of the sea. The waves and currents of the sea are felt like the breezes and winds that you feel on land. Sometimes breezes are soft and gentle and feel wonderful, as they do on a hot summer day. Sometimes the breezes become so strong that it is dangerous to be outside. This often happens during hurricanes. So it is with the waves and currents of the sea.

Happy loved burrows so much. At night before he went to sleep, wise old Claudius the clam, who also lived in burrows along with his friends, would tell a story. Claudius told the greatest stories of all time. He told stories about a little clam that had a lot of curiosity. This little clam had all kinds of adventures and was a great hero in the burrows. Happy wished that he could have an adventure that he could tell his friends about. He would be a hero and everyone would listen to him. Even wise old Claudius would have to listen to him.

One day, Happy decided to take a little bit of a walk outside the burrow. Clams do not walk the way people do. But they do have one foot that they can use to push themselves around from place to place. On this day, Happy wandered a little farther than usual from the burrow. He was thinking about the stories of Old Claudius, about the little clam that had all the adventures. He was daydreaming a bit.

Suddenly his daydreaming was rudely interrupted as something seized him tightly and tried to pry his shell apart. A clam's shell protects him from other animals that might try to eat him, and it is very difficult to break. But Happy was now in the deadly grip of a starfish. The starfish would not be able to break Happy's shell. But the starfish could just keep trying to pull Happy's shell open until Happy got tired of holding his shell closed. If Happy gave up and opened his shell it would be all over. He would be eaten for lunch!

Happy was starting to get tired. His muscle was weak from straining so hard. Just as he felt that he could no longer fight the starfish, an enormous wave swept them from the bottom and Happy and the starfish began bouncing along the bottom and the rocks as the wave swept toward the shore. Apparently a big storm was coming up and the ocean was just beginning to get rough.

As Happy and the starfish bounced around the bottom of the sea, the starfish had to let go to save himself. The ocean saved Happy from being eaten. The starfish had no shell to protect himself the way that Happy did and was getting pretty bruised from being bumped on all those rocks. At first, Happy felt very happy. Wouldn't you if you knew that you weren't going to be eaten for lunch by a starfish! But then he realized he was far, far from home. Besides, he was now very close to shore, and the waves were so rough that his shell was in danger of breaking as the waves bounced him on the rocks near the shore.

Oh, if only I had stayed near the burrow none of this would have happened, he thought to himself. Then he remembered that there was no use crying over what was already done. He was far from the burrow and that was that. He had to get out of this situation and back to his friends. He started working on how he could make himself safe and get out of the terrible waves that were throwing him against the rocks.

In a moment he began to burrow into the sand on the ocean floor. He was digging his own burrow when suddenly he found himself in a burrow that had already been dug by someone else. And he was deep underneath the sand and far away from the dangerous waves sweeping the ocean floor just above the ceiling of his new burrow.

Only this wasn't his burrow. "Who are you?" a high voice said.

"I'm Happy the clam," said Happy in the strongest voice he could. He certainly hoped that this wasn't someone else who would try to eat him. He was still tired from his fight with the starfish and the waves. "Who are you?" said Happy.

"My name is Sandy the mole crab. What are you doing in my burrow?"

And Happy told him all the things that had happened to him. As he talked to Sandy and told him about his friends and his comfortable burrow, he almost started crying. "Oh Sandy, do you think I'll ever be able to find my way back?"

"Don't worry Happy. After the storm is over I'll help you. In the meantime you can stay here and visit with me and we'll be comfortable and snug in my burrow. We'll talk to each other while the storm goes on above us."

In a little while Happy was a comfortable and calm clam. His new friend Sandy told him all about mole crabs and how they lived. Mole crabs dig in the sand. Unlike the clam that has only one foot, they have many feet. The most interesting thing that Sandy told Happy was that mole crabs shed their shell as they grow. Every so often a mole crab would find that his shell was fitting him a bit too tightly just like clothes fit boys and girls too tightly as they grow big and strong. But instead of going to a store or getting new clothes from a brother or sister, the mole crab wiggles out of his too-tight shell and grows a new bigger shell to fit his growing body. Clams don't lose their shells, their shell just grows bigger as they grow. Happy thought it was interesting that both he and Sandy liked to eat the same thing, small plants and animals floating in the ocean. Sandy grabs food with his antennae. Happy pumps water through his body and picks out what he likes to eat.

Happy was just starting to tell Sandy some more things about clams when all of a sudden Sandy's burrow shook terribly and Happy and Sandy were thrown around without warning. A huge wave had come crashing down near Sandy's burrow. Sandy, who was much lighter than Happy, was in danger of being swept away by the raging sea. If that happened it would be all over for little Sandy who was so light that bumping on a hard rock would be the end of him.

Not so with Happy. Happy's shell was much thicker and heavier than Sandy's and although the waves were rough, he was in no danger of being swept away. "Quick Sandy, said Happy, "grab onto my shell and together we can withstand the waves." Sandy did just that, although it was very hard for him to hold on. But in a moment, Happy was able to dig into the sand with his one foot and soon they were both safe and snug again beneath the sand on the ocean floor.

After a while the storm was over and the ocean calmed down. Soon Happy and Sandy were able to come out of their burrow and move on the ocean floor without being swept away by the waves.

Even though he was safe now, Happy was still sad. "Oh Sandy, I miss my old friends and home. The storm has left the ocean so dark and cloudy that you can barely see two inches in front of your face. I just know that I will never see my friends again.

"Don't worry, Happy," said Sandy, "I'll help you. If it weren't for you I would have been swept away by that storm. When the storm passes I promise you I'll help you find a new home." Sandy then helped Happy forget about his troubles by telling him funny stories about the mole crabs in his old home. He told stories almost as well as wise Old Claudius.

After a while, the ocean was calm and clear and the animals that lived there could see better than they could right after the storm. Suddenly they felt the sand shake and tug at them like a vacuum cleaner. Before they knew it, several clams had dug their burrows right near them. Some of the tunnels began to cave in. "Who are you?" exclaimed Happy. The clams traded names and stories. They were all tossed from their burrow during the storm and were afraid and lost. Talk and laughter echoed through the tunnels in the sand. They had become friends.

Happy introduced Sandy to them and they insisted that he stay for awhile. Afterwards Happy told his new friends everything that had happened, telling it better than even wise, Old Claudius could have. That was the best story they had ever heard. "Weren't you afraid, Happy?" asked one of the clams. "Well, maybe, just a little bit," he said and everyone laughed. Finally it was time for Sandy to go and make his way closer to the shore. He said goodbye to Happy and his new friends and went off to find a new home for himself. Before he left, Sandy and Happy said that they would always be friends and that they would never forget how they helped each other. They promised to visit each other often.